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CRYOGENIC, HIGH-RESOLUTION X-RAY SPECTROMETERS FOR SR-XRF AND MICROANALYSIS

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We are developing cryogenically-cooled, broad-band, high-resolution X-ray spectrometers based on superconducting tunnel junction sensors for applications in material science, astrophysics and biophysics. The energy resolution of such cryogenically-cooled detectors operating at temperatures of a few 100 mK can be more than an order of magnitude better than that of the best Si(Li) or Ge detectors. We will present results from first demonstration experiments performed with our prototype detectors at the SSRL synchrotron. Irradiating the detectors directly with the monochromatized synchrotron beam we demonstrated their high count rate capability and good energy resolution. At a total count rate of 2.5 kHz we measured a energy resolution of 8 eV (FWHM) at 277 eV incident energy (corresponding to C K); at a rate of 20 kHz the resolution was 12 eV (FWHM) at 277 eV. Our detectors exhibited similar performance in SR-XRF measurements of samples containing transition metals, low-Z elements and protein molecules. These results show that in the near future such detectors may prove very useful in X-ray fluorescence and microanalysis applications.

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